

# CERES Prototype Ordering Tool Demo

“I think it is important that NASA delivers the data to the US public, obtained with their tax dollars, in a way that are useful for greater good and do not remain confined to only a selected group. ”

(User comment, August 24, 2009)

D. Doelling

*NASA LaRC*

C. Chu, E. Kizer, C. Mitrescu, T. Chee, E. Heckert

*SSAI*



**NASA Langley Research Center / Atmospheric Sciences**



# CERES Tiger Team

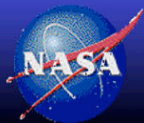
- CERES key concept or product web pages would be explained in a few bullets with expandable pages and hyper-links for more information, instead of the DQS approach which overwhelmed the user
- Every page designed to help the user quickly decide the product for their application, user realizes there are multiple approaches to parameters

D. Doelling

*NASA LaRC*

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D. Rutan\*, P. Taylor<sup>a</sup>, T. Wong<sup>a</sup>

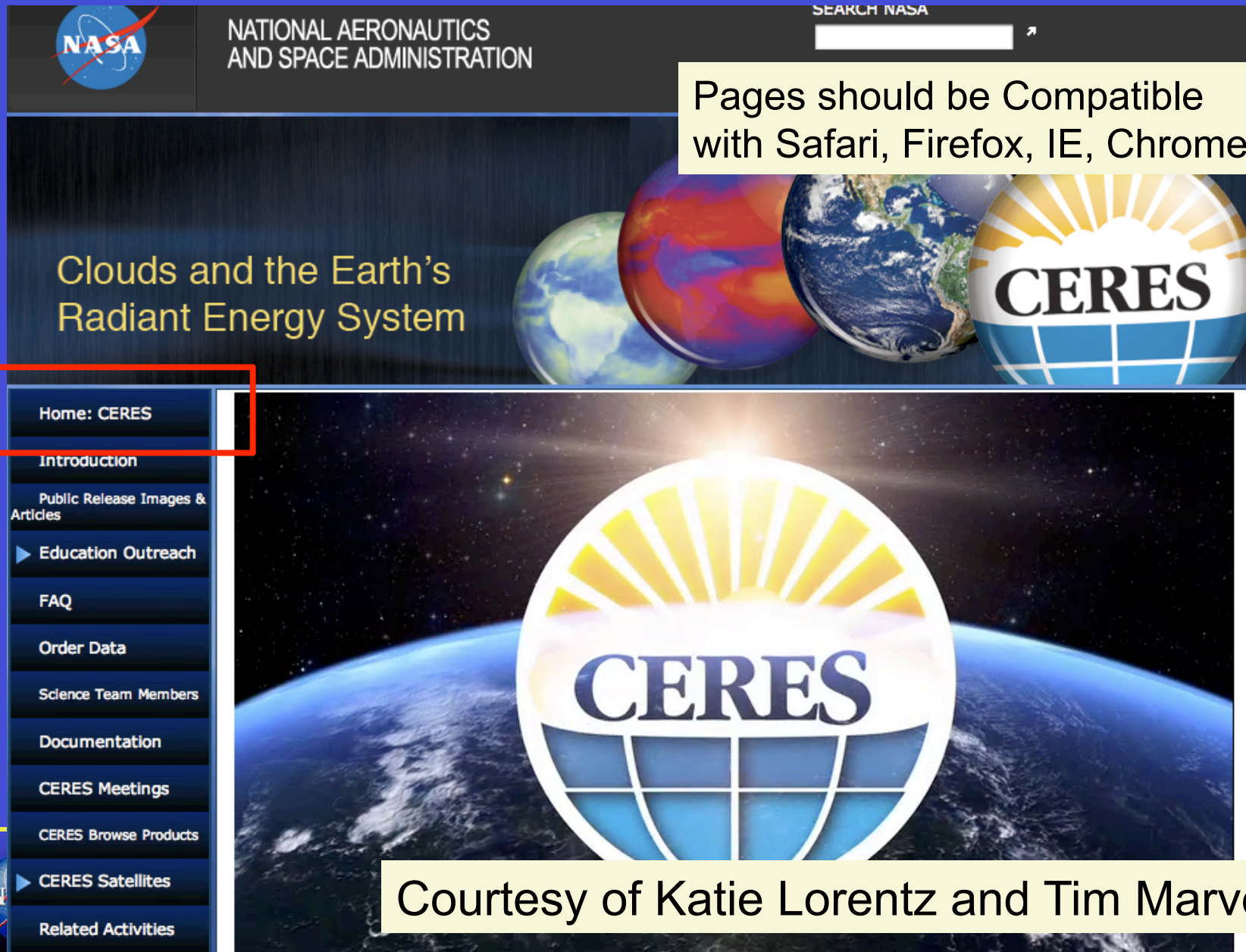
*\*SSAI, <sup>a</sup>NASA LaRC*



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# CERES home page with Movie



# CERES home page with latest News

FAQ

Order Data

Science Team Members

Documentation

CERES Meetings

CERES Browse Products

► CERES Satellites

Related Activities

Earth Observatory

Contact Us

## CERES

### CERES NEWS STORIES

► 4/20/2010: In the News: Climate Change Discussed on "HearSay"

▼ 4/16/2010: In the News: NASA Researchers Aim To Keep 'Infinite CERES' Instrument Going Strong

After more than a decade in orbit, the Clouds and the Earth's Radiant Energy System (CERES), an instrument first launched in 1997, is becoming more useful with each passing year. "Like wine, CERES gets better with time," said Norman Loeb, CERES principal investigator at NASA's Langley Research Center in Hampton, Va. "The longer your data record, the more you learn." Four CERES instruments are gathering data aboard the NASA Earth-observing system's Terra and Aqua satellites. While those sensors continue to function well, scientists are eager to send up additional instruments to ensure a continuous data record, Loeb said.

+ Read the rest [here](#)

► 3/19/2010: New On-Line: Working (Very) Remotely

► 2/23/2010: New On-Line: Cold Snaps Plus Global Warming Do Add Up

► 2/18/2010: In the News: Cuccinelli seeks to block EPA's global-warming petition.

Like wine, CERES gets better with time," said Norman Loeb,



# Public page filled with all news stories



NATIONAL AERONAUTICS  
AND SPACE ADMINISTRATION

SEARCH NASA



Home: CERES

Introduction

**Public Release Images & Articles**

Education Outreach

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CERES Satellites

Related Activities

## CERES Press Releases

- [Evidence for Large Decadal Variability in the Tropical Mean Radiative Energy Budget](#), *Science Magazine*, Feb. 2002
- [Press Release](#): Jan. 2002 *Science* article (Evidence for Large Decadal Variability in the Tropical Mean Radiative Energy Budget)
- [NASA Satellite Instrument Warms Up Global Cooling Theory](#) - (Jan. 2002)
- [Observations of 1998 El Nino Provide Powerful Climate Test](#) - (Dec. 2001)
- [CERES Involved in Showing How Aerosols Cool the Surface But Warm the Atmosphere](#)
- [CERES Terra Press Release](#) - (June 2001)

## CERES Public Release Satellite Images

The following list contains CERES public release satellite images. Click on the highlighted link to obtain a copy of the image.

- I-1:** [CERES Detects Earth's Heat and Energy](#) (Instrument: CERES/Terra, Release Date: 6/21/2001)
- I-2:** [A World of Sunlight and Heat](#) (Instrument: CERES/Terra, Release Date: 6/21/2001)
- I-3:** [Summer Solstice](#) (Instrument: CERES/Terra, Release Date: 6/21/2001)
- I-4:** [Record Setting U.S. Heat Wave](#) (Instrument: CERES/Terra, Release Date: 6/21/2001)
- I-5:** [Deadly Heat Wave in Pakistan](#) (Instrument: CERES/Terra, Release Date: 6/21/2001)
- I-6:** [Effects of Aerosols over the Indian Ocean](#) (Instrument: CERES/Terra, Release Date: 8/13/2001)
- I-7:** [Watching the World Rev its Heat Engine](#) (Instrument: CERES/Terra, Release Date: 2/1/2002)
- I-8:** [Aqua CERES First Light Images](#) (Instrument: CERES/Aqua, Release Date: 7/31/2002)
- I-9:** [Tropical Cloud Systems and CERES](#) (Instrument: CERES/Aqua, Release Date: 11/1/2002)
- I-10:** [ENSO Shortwave Anomalies](#) Image from CERES/TRMM for January 1998 (Source: [Front Cover](#), Preprint of the 10th Conference on Atmospheric Radiation, American Meteorological Society, Release Date: 6/1999)
- I-11:** [All-sky Longwave](#) and [Clear-sky Longwave](#) Images from CERES/TRMM for August 1998 and [ENSO Radiative Anomalies](#)



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# CERES Educational Outreach



# CERES Main data order page

Product Description

Parameter, resolution, Availability

Order Product

Level 4

Level 3

Level 2

Level 1

User feed back

Product Info

All in one  
ordering page

CERES Home

Order Data

Data Resolutions

Data Parameters

Data Availability

Data Products

Science Information

FAQ

A tool to help decide which product meets your application is available [here](#).

Level 4: Consistency between TOA global net flux and ocean heat storage.

Data Product	Description	Parameter	Resolution	Availability	Order Data
<a href="#">EBAF</a>	CERES TOA fluxes, energy balanced and clear-sky filled	<a href="#">i</a>	<a href="#">i</a>	<a href="#">i</a>	<a href="#">Order Data browse &amp; subset</a>

Level 3: Spatial and temporally (daily, monthly, etc) averaged fluxes and cloud properties.

Data Product	Description	Parameter	Resolution	Availability	Order Data
<a href="#">SYN1deg</a>	CERES observed and <a href="#">GEO-enhanced temporally interpolated</a> TOA fluxes, MODIS/GEO clouds and MODIS aerosols and associated computed flux profiles	<a href="#">i</a>	<a href="#">i</a>	<a href="#">i</a>	<a href="#">Order Data browse &amp; subset</a>
<a href="#">SSF1deg</a>	CERES consistent flux and cloud properties	<a href="#">i</a>	<a href="#">i</a>	<a href="#">i</a>	<a href="#">Order Data browse &amp; subset</a>
<a href="#">ES4/ES9</a>	CERES observed <a href="#">temporally interpolated</a> TOA flux, MODIS clouds and aerosols	<a href="#">i</a>	<a href="#">i</a>	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">ISCCP-D2like</a>	CERES observed TOA fluxes using original ERBE algorithms	<a href="#">i</a>	<a href="#">i</a>	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">ISCCP-D2like</a>	CERES monthly cloud properties in a similar format to ISCCP	X	X	X	<a href="#">Available via ASDC Ordering</a>
<a href="#">FLASHFlux1deg</a>	Near real-time SSF1deg product, not officially calibrated for publication	<a href="#">i</a>	X	X	<a href="#">Available via ASDC Ordering</a>

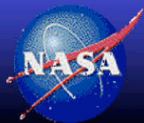
Level 2: CERES instantaneous footprint level fluxes and cloud properties.

Data Product	Description	Parameter	Resolution	Availability	Order Data
<a href="#">SSF</a>	CERES observed TOA flux, MODIS clouds and aerosols and parameterized surface fluxes	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">CRS</a>	Computed flux profiles from MODIS clouds and aerosols	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">ES8</a>	CERES observed TOA fluxes using original ERBE algorithms	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">SSF-SSFM</a>	Nadir view CERES-SSF/MODIS/MISR collocated parameters	X	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">C3M</a>	Nadir view CERES-SSF/MODIS/CALIPSO/CloudSat collocated parameters	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>
<a href="#">FLASHFlux</a>	Near real-time SSF product, not officially calibrated for publication	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>

Level 1B: CERES raw engineering and instantaneous filtered radiances.

Data Product	Description	Parameter	Resolution	Availability	Order Data
BDS	CERES geo-located and calibrated TOA filtered radiances	<a href="#">i</a>	FOV*	<a href="#">i</a>	<a href="#">Available via ASDC Ordering</a>

\*FOV: Field-of-View instantaneous footprint data.



NASA



# Product description

**Level 4:** Consistency between TOA global net flux and ocean heat storage

Data Product	Description	Pa
<a href="#">EBAF</a>	CERES TOA fluxes, energy balanced and clear-sky filled	

**Level 3:** Spatial and temporally (daily, monthly, etc) averaged fluxes and

Data Product	Description	Pa
<a href="#">SYN1deg</a>	CERES observed and <a href="#">GEO-enhanced temporally interpolated</a> TOA fluxes, MODIS/GEO clouds and MODIS aerosols and associated computed flux profiles	
<a href="#">SSF1deg</a>	CERES consistent flux and cloud properties	
<a href="#">ES4/ES9</a>	CERES observed <a href="#">temporally interpolated</a> TOA flux, MODIS clouds and aerosols	
<a href="#">ES4/ES9</a>	CERES observed TOA fluxes using original ERBE algorithms	
<a href="#">ISCCP-D2like</a>	CERES monthly cloud properties in a similar format to ISCCP	
<a href="#">FLASHFlux1deg</a>	Near real-time SSF1deg product, not officially calibrated for publication	

- Short product descriptions are organized by level with hyperlinks identifying major difference between products





# Product Information Page

## CERES EBAF Product

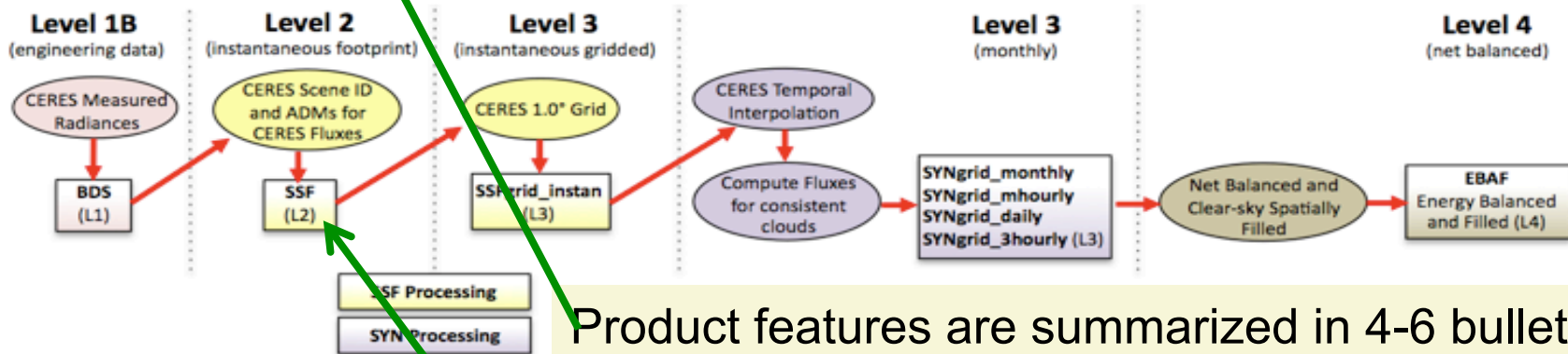
### EBAF - Energy Balanced And Filled

 **Order Data**  
browse & subset

#### EBAF Product Features

- CERES net balanced Top-of-Atmosphere fluxes, where the global net is constrained to the ocean heat storage term
- Spatially interpolates (fills) [clear-sky fluxes](#) in non-observed regions
- EBAF is for climate model evaluation, estimating the Earth's global mean energy budget and to infer meridional heat transport
- EBAF is derived from the SYN product which uses the diurnally complete temporal averaging and the CERES ADMs

#### EBAF Processing Flowchart



#### EBAF Processing Flowchart links

- [CERES Measured Radiances](#)
- [CERES Scene IDs and ADMs for CERES Fluxes](#)
- [CERES 1.0° grid](#)
- CERES Temporal Interpolation
- Compute Fluxes for Consistent Clouds
- [EBAF Net Balanced Fluxes](#)
- [EBAF Clear-sky Filling](#)

Product features are summarized in 4-6 bullets that address product application, again with hyperlinks indentifying major CERES concepts

Processing flowchart  
Flowchart links

# Product Parameter Page

**SYN Product Parameters**

TOA Fluxes (observed and computed)	Surface Fluxes (computed)	Profile Fluxes (computed)	Cloud Properties (MODIS and GEO) [Diurnally Complete]	Aerosols (MOD04)	Atmosphere (GEOS-4)
SW (0-5 $\mu$ m)	Up SW	Up SW	Cloud Area Fraction	Aerosol Visible Optical Depth Percent	Wind Speed
LW (5-100 $\mu$ m)	Up LW	Up LW	Cloud Effective Pressure		Skin Temperature
WN (8-12 $\mu$ m)	Up Wn	Up Wn	Cloud Effective Temperature		LW Surface emissivity
albedo	Down SW	Down SW	Cloud Effective Height		WN Surface emissivity
Net (0-100 $\mu$ m)	Down LW	Down LW	Cloud Top Pressure		Precipitable Water
	Down Wn	Down Wn	Cloud Base Pressure		Total column precipitable water
	Surface Albedo		Cloud Particle Phase		Upper tropospheric precipitable water
			Liquid Water Path		Upper tropospheric humidity
			Ice Water Path		
			Water Particle Radius		
			Ice Particle Effective Diameter		
			Infrared Emissivity		
			Cloud Visible Optical Depth		

- Parameters are organized in categories for easy identification
- The many cloud layers, day/night, and flux clear/all-sky parameters stratifications are not included, but are easily selected when ordering from tool

# Product Resolution Page

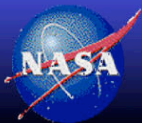
- Level 3 & 4

close ✕

SYN	Regional Grid (1°x1° latitude by longitude)	Zonal (1° latitude)	Global
Hourly	SYN1deg_hourly (along ground track)		
3-Hourly	SYN1deg_3hourly		
Daily	SYN1deg_daily	SYN1deg_daily	SYN1deg_daily
Monthly Hourly	SYN1deg_mhourly	SYN1deg_mhourly	SYN1deg_mhourly
Monthly	SYN1deg_monthly	SYN1deg_monthly	SYN1deg_monthly

- Edition3 product names identify resolution

- Level 2 & 1 all parameters are at the (20 km) footprint resolution



# Product Availability Page

- New Ed2.5 lite products have their own availability and are expected to be processed to Feb 2010 shortly

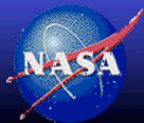
**SSF Product Processing Status**

Product	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SSF1deg-Hour-lite Terra*	Mar								Dec		
SSF1deg-Month-lite Terra*	Mar								Dec		
SSF1deg-Hour Terra	Mar									Apr	
SSF1deg-Hour Aqua			Jul					Dec			
SSF1deg-Month Terra	Mar					Oct					
SSF1deg-Month Aqua			Jul			Oct					

\* Last update April 2010

\* The CERES project is releasing an Edition2.5 "-lite" dataset, where all known CERES instrument artifacts have been removed with Edition2 processing. The objective is to provide the user community a ten year dataset now of the essential climate parameters, while Edition3 is being processed.

- Due to the complex processing schedules, product availability is dependent on product resolution
- Updates to the chart will become automatic in the next version



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# Individual Product Ordering Page

User always gets the latest product edition, user cautioned if new input data is used, such as GOES-4 to 5, which triggers a new letter (2A->2B)

## SSF Level2 File Ordering

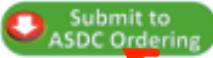
SSF-Instantaneous footprint	Order Data
Subsetting, Visualization and multi-format (netCDF) output ordering tool	N/A
Complete multi-year netCDF CF compliant files	N/A
Tradition full parameter, all inclusive hourly HDF files, To order a month of cross-track data, use the tables below	

Caution: There are two CERES instrument onboard both Terra and Aqua satellites. One is typically in cross-track and the other in a non-standard scan mode (RAPS, PAPS or FAPS). The cross-track instrument is recommended by the CERES, since the spatial distribution of footprints is uniform. Compare spatial sampling [here](#).

**Terra Satellite** (10:30 AM Equator Crossing)

**Aqua Satellite** (13:30 PM Equator Crossing) [Part of A-Train suite of satellites]

The table below is for selecting the instrument in cross-track mode for the selected satellite-year-month. A generated link is provided to the ASDC Ordering Tool.

Product	Satellite	Year	Month	Order Data
SSF	<input checked="" type="radio"/> Terra <input type="radio"/> Aqua	2000	March	

User will be directed to the ASDC ordering page

- The level 2 ordering page cautions and guides users in determining which CERES instrument was in cross-track mode and will actually select those files at the ASDC ordering page for the month selected

# Product Tool Selection Page

User selections

**S\_EBAF\_TOA\_Terra\_Edition1A Subsetting**

Parameters	<input checked="" type="checkbox"/> TOA Fluxes	<input checked="" type="checkbox"/> Shortwave Flux	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> CRE Fluxes	<input type="checkbox"/> Longwave Flux	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Solar Flux	<input type="checkbox"/> Net Flux	<input type="checkbox"/>	<input type="checkbox"/>
Temporal Resolution	<input checked="" type="radio"/> Monthly Mean <input type="radio"/> Climate			
Spatial Resolution	<input checked="" type="radio"/> Regional (1° x 1° global grid) <input type="radio"/> Zonal mean <input type="radio"/> Global mean			
	Top: <input type="text" value="90"/> Left: <input type="text" value="-180"/> <input type="text" value="180"/> Right: <input type="text"/> Map			
Satellite	<input checked="" type="radio"/> Terra (3/2000 - 10/2005)			
Time Range	From: <input type="text" value="03"/> - <input type="text" value="2000"/> (MM-YYYY) To: <input type="text" value="10"/> - <input type="text" value="2005"/> (MM-YYYY)			
Email Address	<input type="text" value="david.r.doelling@nasa.gov"/> By of a rele			

Show expandable parameter lists

CERES team saved every parameter, however user wants only a few, parameters are organized

Can select regions using google maps

Time range is filled in entire time record

Email is used to inform users of later revisions or new products

Sciences



# Parameter Definitions

## CERES Parameter Information: Shortwave Flux; TOA and SFC

### Description

#### TOA Shortwave Flux

The **TOA Up Shortwave (SW) Flux**, is the CERES-observed broadband (0.2-5 $\mu$ m) shortwave reflected (upwelling) flux at the top of the atmosphere (TOA - around 20 km altitude). The upwelling flux is defined as positive. The TOA SW absorbed is the incoming solar flux minus the SW reflected flux.

When the solar zenith angle is greater than 90°, **twilight flux** (Kato and Loeb, 2003) is added to the SW flux take into account the atmospheric refraction of light. The magnitude of this correction varies with latitude and season. In general, the regional correction is less than 0.5 W m<sup>-2</sup> and the global mean correction is 0.2 W m<sup>-2</sup>.

The CERES footprint fluxes are first **spatially averaged** into 1° latitude by 1° longitude gridded regions. The gridded fluxes for a given region are then diurnally averaged using **CERES (GEO-enhanced) flux temporal interpolation** algorithm in between Terra (10:30AM equator local time) or Aqua (1:30PM) observations and to derive the daily/monthly regional means. Fluxes are also zonally and globally averaged. Moreover only the CERES instrument measurements in **cross-track mode** are used to ensure uniform sampling

It is important not to mix CERES product (EBAF, SYN1deg, SSF1deg, etc) fluxes, since they were obtained with differing algorithms.

links provided in next version

▶ EBAF clear-sky spatially filled fluxes

▶ EBAF net balanced fluxes

▶ Sample Images

- All Parameters definitions are expandable
- Simple explanation with pertinent cautions, for example twilight
- Parameter plot examples are given

## CERES Parameter Information: Shortwave Flux; TOA and SFC

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▶ EBAF clear-sky spatially filled fluxes

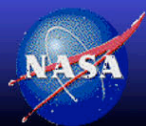
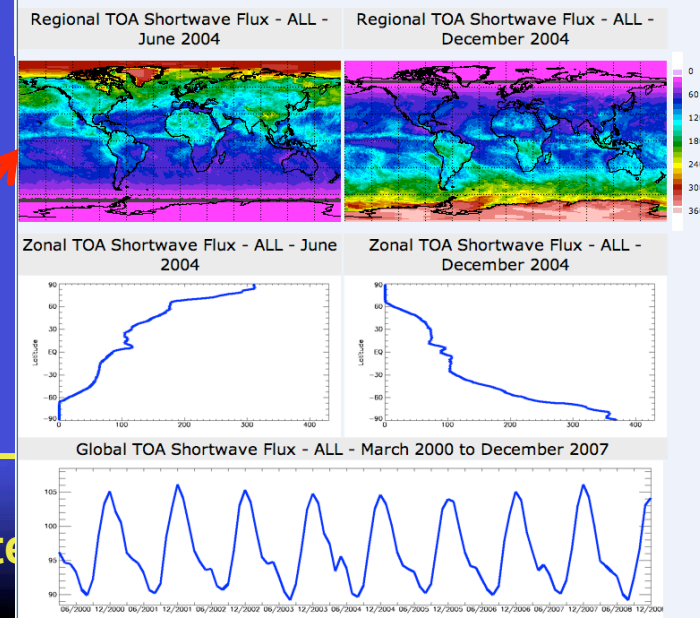
The **clear-sky** scene is determined from CERES footprints (20 km nominal resolution) that are 99% clear, as identified by CERES-MODIS clear-sky mask from the MODIS pixels contained within the CERES footprint. However, there are many cloudy regions (like ITCZ, maritime stratus, etc.) that may not have any clear-sky observations for one particular month. The EBAF product has **clear-sky filled** all non-observed clear-sky regional fluxes for a complete clear-sky global map. All temporal and spatial domains should have clear-sky fluxes.

▶ EBAF net balanced fluxes

The CERES EBAF fluxes are derived from the SYN product, but have been **net balanced** to attain a net global annual flux of 0.85 Wm<sup>-2</sup>, the estimated ocean heat storage term based on Hansen et al. (2005). An objective constraint algorithm is used to derive optimal adjustments for the other TOA flux components from the SYN product, (Loeb et al. 2008), in order to compare with climate models. When comparing CERES clear-sky fluxes to modeled (GCM, radiative transfer) fluxes it is important to remember that CERES defines its clear-sky over large areas, essentially a clear-sky profile, and not a cloudy sky profile with the clouds removed. Further information can be obtained in the

### Sample Images

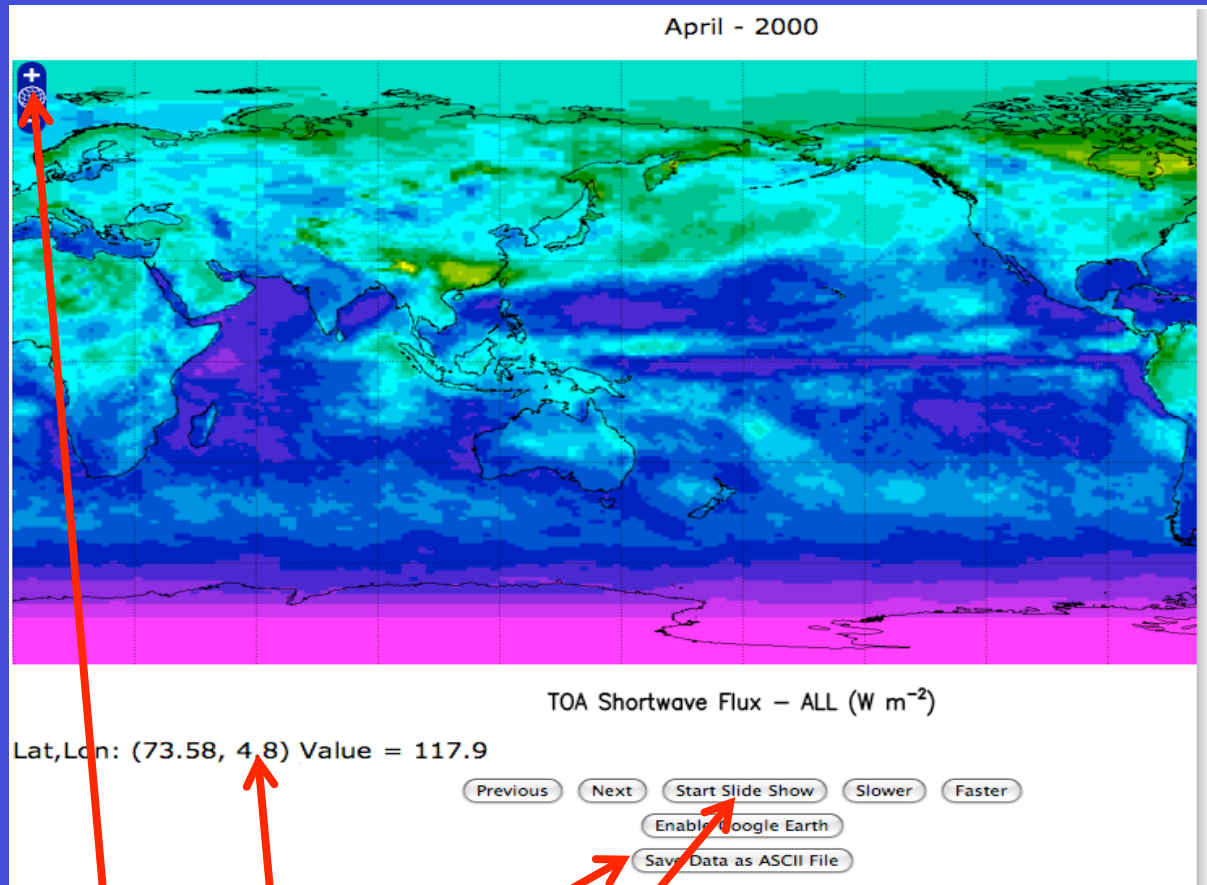
These plots are for illustration only and are not representative of the product selected. Please select data and click "plot data" on the ordering page to view relevant up-to-date plots.



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# Product Plotting Page



- Can save data as ascii and gif images (next version)
- Can resize map
- Can animate regional plot over many months
- Can map either over earth or rectangle projection
- Can place cursor over plot and identify values



# Product Download Page

summary of selection

**Order: 1/1/2010 12:25:03 101**

<b>Product:</b>	SRBAVGLite	<b>Satellite:</b>	TERRA
<b>Temporal Resolution:</b>	Every 10 Days, Monthly	<b>Spatial Resolution:</b>	REGIONAL
<b>Number of Parameters:</b>	10	<b>Number of Files:</b>	1
<b>Total file size:</b>	0	<b>Time Range:</b>	03/2000 - 12/2007
<b>Data Product Catalog:</b>	<a href="#">See Data Info</a>		

Note: data files will be deleted within 15 minutes. Up to 10GB of data can be ordered through this page.

## Files

File Number	Time Range	File Size	Dimensions of Parameters	Created on: Date and Time	Action
1	03/2000 - 12/2007	0.73 GB	360x180x3x94	2010-03-22 08:55:27	<a href="#">Download</a>

List of dimensions

Number	Name	Size	Comment
1	Longitude	360	Starts at Date Line; 1 DEG resolution
1	Latitude	180	Starts at Noth Pole; 1 DEG resolution
1	Time	86	Begins with ; 1 month

## Parameters

Index	Standard Name	Units	Valid Range Min	Valid Range Max
0	TOA Shortwave Flux - CLR	W m-2	0.00000	800.000
1	TOA Shortwave Flux - ALL	W m-2	0.00000	800.000
2	TOA Longwave Flux - ALL	W m-2	0.00000	400.000
3	TOA Window-region Flux - CLR	W m-2	0.00000	400.000
4	TOA Net Flux - ALL	W m-2	-400.000	400.000
5	TOA Albedo - CLR	unitless	0.00000	1.00000
6	TOA Albedo - ALL	unitless	0.00000	1.00000
7	Cloud Effective Temperature - DAY	K	180.000	350.000
8	Cloud Effective Pressure - DAY	hPa	0.00000	1050.00
9	Cloud Effective Pressure - DAY-NIGHT	hPa	0.00000	1050.00

Date/Time of Order: null. Please download now.

- CF compliant netCDF output, and parameter definitions
- Data Products Catalogues (DPC) with only the parameters selected
- IDL and Fortran netCDF read software
- Download from web

List of parameters

- Entire record of monthly means can be ordered as one file (2GB limit)
- No need to combine 108 monthly files x 2 GB to get 108 global means

# CERES tool

- Load tool on newly purchased CERES web servers
  - Clean up pages and take user suggestions
  - Take down tool for a few weeks
  - Have EBAF, SSFlite, SYNlite, and ES4 online
- Develop level 3 parameter product comparison plotting package
  - Add new products as they become available as Ed3
- Develop level 2 footprint product pages as Ed3 comes online
  - Subset spatially (say over a surface site) and by parameter
- Develop user product and parameter ordering statistics

